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INTERIM REPORT - UPPER OTTAWA
STREET LANDFILL SITE STUDY,
REFERENCE PAPER 25 :
INHERENT TOXIC PROPERTIES...

CIPAL

REFERENCE 25

PRELIMINARY SUMMARY OF
THE INHERENT TOXIC PROPERTIES OF
SELECTED SUBSTANCES TENTATIVELY IDENTIFIED AT
UPPER OTTAWA STREET LANDFILL

Prepared For:

UPPER OTTAWA STREET LANDFILL
SITE STUDY
HAMILTON, ONTARIO

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I. PURPOSE OF THE REPORT

The development of an appropriate investigational method to assess the health of workers once employed at the Upper Ottawa Street Landfill should be guided by a review of the inherent toxic properties of the substances to which they may have been exposed. In this report we present such a review, although it is highly limited and should be used only for assistance in design of the planned health survey. The type of review presented was designed only to provide information on the types of toxic injury or disease that might be expected should exposure to substances at the landfill have occurred at sufficiently high levels and for sufficiently long periods of time. We make no attempt in this report to define either of these exposure parameters.

II. DEFINITION OF TERMS

The key phrase in this review is "inherent toxicity." By this phrase we mean the inherent capacity of a given substance to cause some type of toxic injury or to initiate a disease process, without regard to the conditions of exposure necessary to produce any such effects. Although in the case of a few chemicals very low doses can cause adverse effects, most of the chemicals tentatively identified are hazardous only at high levels of exposure. The actual conditions of worker exposure to the substances reviewed are not known nor can they be reasonably estimated. It is thus not possible to determine, without further analysis, whether any of the substances reviewed actually caused injury or disease. The further analysis will consist of the survey of health status of the workers.

At this stage, the data on inherent toxicity derive entirely from secondary sources. They have been organized according to the various organs of the body that are known to be sites or targets of toxic action (e.g., kidney, lungs, liver, etc.), certain target systems (e.g., nervous system, immune system, etc.), and certain disease states (e.g., cancer, birth defects, etc.). No attempt has been made to identify the specific type of injury or effect that can be produced by these substances, or to assess the severity or degree of reversibility of the effects. (To do so would require extensive consultation of the primary scientific and medical literature.) In some instances, inferences about possible effects were made on the basis of their chemical structures.

III. SOURCES AND ORGANIZATION OF DATA

A substantial amount of sampling and analytical data has been collected at the landfill. Data were collected at different times and by different laboratories. We have examined these data and developed four lists of chemicals from them. The decision to group the chemicals into four groups was based on the media sampled (e.g., air vs. soil and water), and on the extent to which a specific group of chemicals can be said to be homogenous with respect to the degree of confidence that can be placed in the analytical findings. Using these criteria, the four lists of chemicals selected for review are the following.

(A) Mann Labs, Soils and Water

Chemicals identified in reports of May 14, August 4, and October 1, 1982 with a "purity" or "fit" value of 800 or greater. For most chemicals, a "fit" value of 800 or more is a good indication that the computer identification is correct, or that the real chemical is structurally related to the one identified. But for some chemicals, for example, those of low molecular weight, a value of 850 or more is needed to ensure reliable identification. By using 800 as a cut off, we are erring on the side of safety to avoid overlooking some hazardous low molecular weight chemicals.

(B) Mann Labs, Air

Chemicals identified in test well gases sampled October 20 and 21, 1982 and in air samples taken on and around the site on November 18, 1982. The degree of confirmation of identity of specific chemicals is uncertain at this time.

(C) Metals, Soil and Water

Metals identified in the Crossley Report, February 1982.

(D) Miscellaneous Data Collected During 1977-1981. Soil, Water, and Air

Specific chemicals identified in other sampling, mostly by the Ministry of the Environment and not appearing in A, B, or C. The degree of confirmation of identity of specific chemicals is uncertain.

The four groups of chemicals are listed in Tables 1, 3, 5, and 7. Some chemicals were grouped as a class of related structural types because many representative members of the class were identified as present and because



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important differences in toxicity are either not known or not likely to occur among them. Where differences are known, individual compounds were separated from the class (e.g., n-hexane is treated differently from the other n-alkanes). Each chemical or chemical class was assigned a number to simplify presentation of the inherent toxicity data. Immediately following the table listing a group of chemicals, appears a table containing the inherent toxicities of those chemicals (listed by number). Thus, Table 2 contains the inherent toxicity data on chemicals listed in Table 1, and coded as in Table 1. Tables 3 and 4, Tables 5 and 6, and Tables 7 and 8 are related in this same way.

The sources of inherent toxicity data were the following:

- American Conference of Governmental Industry Hygienists, Inc. 1981. Documentation of the Threshold Limit Values. 4th Edition. ACGIH. Cincinnati, Ohio
- Clayton, G.D. and Clayton, F.E. 1982. Patty's Industrial Hygiene and Toxicology. Vols. 2A, 2B, and 2C, Third Revised Edition. John Wiley and Sons, Inc. New York
- Doull, J., Klaasen, C.D., and Amdur, M.D. 1980. Casarett and Doull's Toxicology. 2nd Edition, McMillan Publishing Co., Inc. New York
- National Research Council, Safe Drinking Water Committee, 1977. Drinking Water and Health. National Academy of Sciences Washington, D.C.
- National Research Council, Safe Drinking Water Committee, 1980. Drinking Water and Health, Vol. 3 National Academy Press, Washington, D.C.
- NIOSH, 1979. Registry of Toxic Effects of Chemical Substances. U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health. Cincinnati, Ohio 45226

As previously noted, the experimental conditions under which these various forms of toxicity have been observed are not noted because they are not relevant to the purpose of this review.

IV. RESULTS

The results of this review are readily discerned in Tables 2, 4, 6, and 8. Before drawing conclusions from the results, one further qualification should be noted. The abundance of toxicity data in certain areas (e.g., eye irritation) and their relative lack in other (e.g., toxic effects on the immune system) are in part due to the differences in the availability of methodology with which different types of data are collected. Thus, toxicologists have devoted considerable attention to certain types of toxicity, and have accordingly developed appropriate experimental methodology, and have paid much less attention to other areas. The extent to which this artifact of testing influences the data collected in Tables 2, 4, 6 and 8 can not be estimated, but it is surely a factor.

Nonetheless, the data shown do represent the extent of knowledge, and can be used to guide the planned health survey. Moreover, the data collected in these tables adequately demonstrate the need for a comprehensive health survey of workers who might have been exposed to many of the substances listed. It is probable that certain types of toxicity should be more thoroughly investigated than others, but the wide variety of likely effects suggests the need for a comprehensive evaluation. It should be noted that even effects for which the evidence is relatively meagre (e.g., effects on several of the endocrine glands), may nevertheless be important if the substances capable of producing them act at relatively low doses.

We finally reemphasize that the data presented in this review serve no purpose but to guide the planned health surveys, and do not reveal any information about actual health risk.

TABLE 1

CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS IN WATER AND SOIL SAMPLES

1. Aliphatic alcohols, C₆-C₁₉
2. Aliphatic aldehydes, C₆-C₁₀
3. Aliphatic esters
4. Aliphatic ethers C₄-C₁₁
5. Alkenes C₄-C₁₀
6. Alkyl benzenes
7. Alkyl ketones, C₃-C₉
8. Aniline
9. Benzene
10. Benzene acetaldehyde, α -methyl-
11. Benzene butanoic acid, 2,5-dimethyl-
12. Benzene methanol, α , α -dimethyl
13. Benzene propanoic acid
14. Benzoic acid
15. Benzoic acid, 3,4-dimethyl
16. Benzoic acid, 4-(1,1-dimethylethyl)-
17. Benzothiazole, 1-(methylthio)-
18. 2(3H)-Benzothiazolone
19. Benzo[b]thiophene
20. Bicyclic aliphatics

TABLE 1

CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS IN WATER AND SOIL SAMPLES

(Continued)

21. Butane, 2-azido-2,3,3-trimethyl-
22. 9H-Carbazole
23. Carbon disulfide
24. Carboxylic acids (simple)
25. Cycloheptatriene
26. Cyclohexane, methyl
27. Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1 α , 2 α , 5 β
28. Cyclohexanone, 3,3,5-trimethyl-
29. Cyclohexene, 3-methylene-6-(1-methylethyl)-
30. 2-Cyclohexen-1-ol
31. 2-Cyclohexen-1-one
32. 2-Cyclohexen-1-one, methylated (3-, 3,4,5-, 3,5,5-)
33. Cyclooctane, 1,4-dimethyl, trans-
34. Cyclopentane, 1,2-dimethyl-, cis-
35. Cyclopentene, 1-ethenyl-3-methylene-
36. Cyclopropane, 1-butyl-1-methyl-2-propyl-
37. Cyclopropane, 1,1-dibromo-2-chloro-2-fluoro-
38. Dibenzofuran
39. Dibenzofuran, 4-methyl-

TABLE 1

CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS IN WATER AND SOIL SAMPLES

(Continued)

- 40. 1,3,-Dioxane
- 41. 1,4-Dioxane
- 42. 1,4-Dioxolane, 4-methyl
- 43. Dodecanamide
- 44. Ethanone, 1-(2-methyl cyclopropyl)-
- 45. Ethene, 1,2-dichloro-, (z)-
- 46. Ethene, 1,1-dichloro-
- 47. Ethene, trichloro-
- 48. Tetrahydrofuran and derivs.
- 49. Guanidine
- 50. Hexane
- 51. Hydrazine, 1,2-dimethyl
- 52. Hydroxylamine, O-decyl-
- 53. Isoquinoline
- 54. 1(2H)-Isoquinolinone
- 55. Methane, thiobis-
- 56. Morpholine, 4-acetyl-
- 57. Morpholine, 3,5-dimethyl-4-nitroso-
- 58. Morpholine, 4, 4'-methylenebis

TABLE 1

CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS IN WATER AND SOIL SAMPLES

(Continued)

- 59. Napthalene, decahydro-2-methyl-
- 60. Nitriles (butane and propane)
- 61. Nonanamide
- 62. Oxazolidinone, 3-(2-hydroxypropyl)-5-methyl-
- 63. PAH's
- 64. PCBs
- 65. 2-Pentene, 5-bromo-2,3-dimethyl-
- 66. Phenol
- 67. Alkyl phenols
- 68. Phthalate, di(2-ethyl hexyl)-
- 69. Phthlates - others
- 70. Picoline, 6-nitro-
- 71. Piperidinone
- 72. 2H-Pyran-2-one
- 73. Pyridine, 3-(1-methyl-2-pyrrolinyl)-(s)- [nicotine]
- 74. Pyrrolidinone, 1-methyl-
- 75. Thiophene, tetrahydro-, 1,1-dioxide

TABLE 2

POSSIBLE TARGET SITES AND EFFECTS OF CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS
IN WATER AND SOIL SAMPLES FROM UPPER OTTAWA STREET LANDFILL

EFFECTS	CHEMICALS
Eye irritation	1, 2, 3, 4, 5, 6, 7, 9, (10), (11), (12), (13), (14), (15), (16), 23, 24, 25, (27), (28), (29), (30), (31), 32, (35), 41, 46, 47, 50, 51, 55, 56, (59), 63, 66, 67, 68, (69), (70), (71), 73, (74)
Eye damage	63
Skin irritation	1, 2, 3, 4, 5, 6, 7, 9, (10), (11), (12), (13), (14), (15), (16), 23, 24, 25, 26, (27), (28), (29), (30), (31), 32, (33), (34), (35), 41, 46, 47, (48), 50, 51, 56, (59), 63, 66, 67, 68, (69), (70), (71), 73
Skin damage (chloracne)	64
Allergic sensitization	9, (17), (18), 23, (51), 63, 73
Upper Respiratory tract irritation	1, 4, 5, 6, 23, 24, (28), 32, 41, 46, 50, (56), 63, 66, (69), (70), (74)
Lung damage	46, (59), 64, 66, 67, (70), (74)
Liver damage	1, 3, 7, (26), (27), 41, (44), 45, 46, (48), (51), (56), (59), 63, 64, 66, 67, (70), (74)
Porphyrria	64
Kidney damage	1, 7, (26), 41, 46, (48), (56), (59), 66, 67, (70), (74)
Adrenal damage	46
Central nervous system depression	6, 9, (28), (29), (30), (31), 32, (44), 45, 46, 47, 48, 50, 66, 67, (70), (71), 73, (74)
Narcosis	1, 2, 3, 4, 5, 6, 7, 9, (28), (29), 32, (34), (44), 45, 46, 47, 48, 50, (70)
Central nervous system damage	1, (21), 23, 51, 66, 67
Peripheral nervous system damage	9, 23, 50, 66
Blood cell disorders	9, 23, 63, 73
Hemolysis	(51)
Anoxia	60
Methemoglobinemia	8
Immunological effects	9, 47, 64
Spleen damage	67
Thyruis damage	64
Cardiovascular effects	(5), 7, 9, (21), 23, 46, 47, 48, 66, 67, 73, (74)
Gastrointestinal effects	23, (56), 64, 66, 67, (70), 73, (74)
Pancreatic damage	67
Endocrine disorders	23
Bone disorders	64
Reproductive effects	5, 46, 63, 64, 73
Embryotoxicity	63, 64, 73
Teratogenicity	46, 47, (51), 63, 73
Mutagenicity	8, 9, 41, 46(?), 47, 51, (57), 58(?), 63, 64, 68
Carcinogenicity	66
Tumor promotion	

NOTES: a. Parentheses () indicate that no data was found for the particular chemical but closely related chemicals have the effect noted. A question mark (?) indicates that the evidence for a particular effect is not conclusive.

b. Where classes of chemicals are indicated, not all members of the class cause all the effects noted.

TABLE 3

CHEMICALS TENTATIVELY IDENTIFIED BY MANN LABS IN AIR SAMPLES

1. Aliphatic alcohols
5. Alkenes
6. Alkyl benzenes
7. Alkyl ketones
9. Benzene
76. Chloroform
77. "Dichlorobenzene"
78. "Dichloroethane"
79. "Dichloroethylene"
80. Dichloromethane
81. Dimethyl disulfide
82. Dimethyl sulfoxide
41. 1,4-Dioxane
50. Hexane
83. Indene and methyl indene
84. Naphthalene
85. Styrene
86. Tetrachloroethylene
48. Tetrahydrofuran
87. "Trichloroethane"
47. Trichloroethylene

NOTE: For chemicals 77, 78, 79 and 87, the particular isomer present was not identified. In table 4, the effects listed for these chemicals are composites of the effects of the different isomers.

TABLE 4

POSSIBLE TARGET SITES AND EFFECTS OF CHEMICALS
TENTATIVELY IDENTIFIED IN AIR BY MANN LABS

EFFECTS	CHEMICALS
Eye irritation	1, 5, 6, 7, 9, 76, 77, 78, 79, 80, 82, 41, 50, 84, 85, 86, 87, 47
Eye damage	84
Skin irritation	1, 5, 6, 7, 9, 76, 77, 78, 79, 80, 82, 41, 50, 83, 84, 85, 86, 48, 87, 47
Skin damage (chloracne)	
Allergic sensitization	
Upper Respiratory tract irritation	1, 5, 6, 77, 78, 41, 50, 83, 84, 85, 86, 48
Lung damage	78, 79
Liver damage	1, 7, 76, 77, 78, 79, 80, 41, 83, 86, 48, 87
Porphyria	77
Kidney damage	1, 7, 76, 77, 78, 79, 41, 83, 86, 48, 87
Adrenal damage	78
Central nervous system depression	6, 9, 76, 78, 79, 80, 41, 83, 86, 48, 87, 47
Narcosis	1, 5, 6, 7, 9, 76, 78, 79, 80, 50, 48, 87, 47
Central nervous system damage	1
Peripheral nervous system damage	9, 50
Blood cell disorders	9, 77, 84
Hemolysis	84
Anoxia	
Methemoglobinemia	
Immunological effects	9, 47(?)
Spleen damage	83
Thymus damage	
Cardiovascular effects	5, 7, 9, 78, 79, 48, 47
Gastrointestinal effects	76, 78, 86
Pancreatic damage	
Endocrine disorders	
Bone disorders	
Reproductive effects	
Embryotoxicity	5, 76, 79, 80, 86
Teratogenicity	81
Mutagenicity	78, 79, 47
Carcinogenicity	9, 76, 78, 41, 85(?), 86, 87, 47
Tumor promotion	

TABLE 5

METALS TENTATIVELY IDENTIFIED IN CROSSLEY REPORT

- 88. Aluminum
- 89. Arsenic
- 90. Cadmium
- 91. Chromium
- 92. Copper
- 93. Iron
- 94. Lead
- 95. Manganese
- 96. Nickel
- 97. Zinc

TABLE 6

POSSIBLE TARGET SITES AND EFFECTS OF METALS
TENTATIVELY IDENTIFIED IN CROSSLEY REPORT

EFFECTS	CHEMICALS
Eye irritation	
Eye damage	
Skin irritation	91, 97
Skin damage (chloracne)	
Allergic sensitization	91, 95, 96
Upper Respiratory tract irritation	90, 91
Lung damage	90, 91, 93, 96
Liver damage	92, 96, 97
Porphyria	
Kidney damage	90, 92, 94, 96
Adrenal damage	
Central nervous system depression	
Narcosis	
Central nervous system damage	92, 94, 95
Peripheral nervous system damage	89, 94
Blood cell disorders	89, 91, 94, 97
Hemolysis	
Anoxia	
Methemoglobinemia	
Immunological effects	94(?)
Spleen damage	92
Thymus damage	
Cardiovascular effects	94, 96
Gastrointestinal effects	88, 89, 90, 91, 92, 93, 96, 97
Pancreatic damage	
Endocrine disorders	89, 94
Bone disorders	88, 90
Reproductive effects	90, 94, 96, 97
Embryotoxicity	94
Teratogenicity	89
Mutagenicity	
Carcinogenicity	89, 90, 91, 96
Tumor promotion	

TABLE 7

CHEMICALS TENTATIVELY IDENTIFIED IN EARLIER SURVEYS
NOT APPEARING IN TABLES 1-6

- 98. BHC and Lindane
- 99. Carbon tetrachloride
- 100. Dieldrin
- 101. Endrin
- 102. Heptachlor epoxide

TABLE 8

POSSIBLE TARGET SITES AND EFFECTS OF CHEMICALS TENTATIVELY
IDENTIFIED IN EARLIER SURVEYS NOT APPEARING IN TABLES 1-6

EFFECTS	CHEMICALS
Eye irritation	
Eye damage	
Skin irritation	
Skin damage (chloracne)	
Allergic sensitization	
Upper Respiratory tract irritation	
Lung damage	100
Liver damage	98, 99, 100, 101, (102)
Porphyria	
Kidney damage	98, 99, 100, 101
Adrenal damage	101
Central nervous system depression	98, 99
Narcosis	99
Central nervous system damage	98, 100, 101, (102)
Peripheral nervous system damage	
Blood cell disorders	98
Hemolysis	
Anoxia	
Methemoglobinemia	
Immunological effects	
Spleen damage	
Thymus damage	
Cardiovascular effects	
Gastrointestinal effects	99
Pancreatic damage	
Endocrine disorders	
Bone disorders	
Reproductive effects	100, 101
Embryotoxicity	99, 100, 101
Teratogenicity	100, 101
Mutagenicity	
Carcinogenicity	98, 99, 100 (102)
Tumor promotion	

ADDENDUM TO
PRELIMINARY SUMMARY OF
THE INHERENT TOXIC PROPERTIES OF
SELECTED SUBSTANCES TENTATIVELY IDENTIFIED
AT UPPER OTTAWA STREET LANDFILL

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The following is intended as an addition to our report of January 5, 1983, and the chemicals and tables are numbered to follow those in the main report. All of the general considerations regarding the purpose and scope of that work apply to the data presented here. In particular it must be reemphasized that the "effects" listed are generally those that have been reported under rather extreme conditions of exposure. The purpose of these tables is to help guide the planned health survey to ensure that the survey is designed to detect adverse effects of the types that may have been caused by chemicals tentatively identified at the landfill.

Tables 9 and 10 list additional chemicals and possible effects of those chemicals that have been tentatively identified by Sciex in air samples before and after attempts to burn gases being vented from the landfill, and that do not appear in Tables 1-8.

TABLE 9

ADDITIONAL CHEMICALS TENTATIVELY IDENTIFIED IN AIR BY SCIEX

- 103. Acrylic acid
- 104. Benzaldehyde
- 105. Benzaldehyde, methyl-
- 106. Carbaryl
- 107. Methane, nitro-
- 108. Pyridine, methyl-
- 109. Styrene

TABLE 10

POSSIBLE TARGET SITES AND EFFECTS OF CHEMICALS
TENTATIVELY IDENTIFIED IN AIR BY SCIEX

EFFECTS	CHEMICALS
Eye irritation	103, 104, 105, 108, 109
Eye damage	103
Skin irritation	103, 104, 105, 108, 109
Skin damage (chloracne)	
Allergic sensitization	103, 104
Upper Respiratory tract irritation	103, 107, 108, 109
Lung damage	107
Liver damage	106, 107
Porphyria	
Kidney damage	103, 106, 107
Adrenal damage	
Central nervous system depression	104, 107, 108, 109
Narcosis	108, 109
Central nervous system damage	
Peripheral nervous system damage	
Blood cell disorders	
Hemolysis	
Anoxia	
Methemoglobinemia	
Immunological effects	
Spleen damage	
Thymus damage	
Cardiovascular effects	
Gastrointestinal effects	103
Pancreatic damage	
Endocrine disorders	
Bone disorders	
Reproductive effects	
Embryotoxicity	103, 106(?)*
Teratogenicity	103, 106(?), 108(?)
Mutagenicity	106(?), 108(?)
Carcinogenicity	
Tumor promotion	

* A question mark (?) indicates that the evidence for an effect is not conclusive.

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